Cellular Protocols

GSM

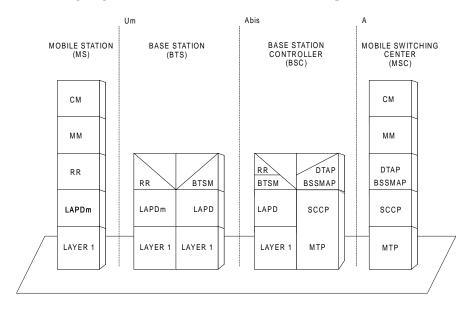
In 1989, the European Telecommunication Standards Institute (ETSI) took over responsibility for GSM. Phase I of the GSM specifications were published in 1990, commercial service was started in mid-1991, and by 1993 there were 36 GSM networks in 22 countries. In addition to European countries, South Africa, Australia, and many Middle and Far East countries have chosen GSM. At the beginning of 1994, there were 1.3 million subscribers worldwide. The acronym GSM now aptly stands for Global System for Mobile telecommunications.

GSM was intended to be compatible with ISDN in terms of services offered and control signalling used. However, the standard ISDN bit rate of 64 Kbps could not be practically achieved due to the limitations of the radio link. The digital nature of GSM allows data, both synchronous and asynchronous, to be transported as a bearer service to or from an ISDN terminal. The data rates supported by GSM are 300, 600, 1200, 2400, and 9600 bps.

The most basic teleservice supported by GSM is telephony. A unique feature of GSM compared to older analog systems is the Short Message Service (SMS).

Supplementary services are provided on top of teleservices or bearer services, and include features such as international roaming, caller identification, call forwarding, call waiting, multi-party conversations and barring of outgoing (international) calls, among others.

The following diagram illustrates the structure of the GSM protocol family:



GSM protocol family structure

CDMA

Code Division Multiple Access (CDMA) is a digital air interface standard, claiming eight to fifteen times the capacity of traditional analog cellular systems. It employs a commercial adaptation of a military spread-spectrum technology. Based on spread spectrum theory, it gives essentially the same services and qualities as wireline service. The primary difference is that access to the local exchange carrier (LEC) is provided via a wireless phone.

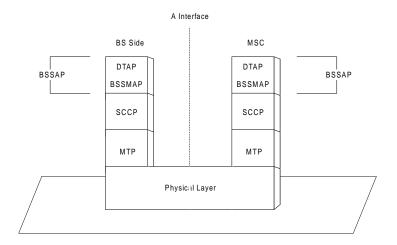
Though CDMA's application in cellular telephony is relatively new, it is not a new technology. CDMA has been used in many military applications, such as:

- Anti-jamming (because of the spread signal, it is difficult to jam or interfere with a CDMA signal).
- Ranging (measuring the distance of the transmission to know when it will be received).
- Secure communications (the spread spectrum signal is very hard to detect).

CDMA is a spread spectrum technology, which means that it spreads the information contained in a particular signal of interest over a much greater bandwidth than the original signal. With CDMA, unique digital codes, rather than separate RF frequencies or channels, are used to differentiate subscribers. The codes are shared by both the mobile station (cellular phone) and the base station, and are called pseudo-random code sequences. Since each user is separated by a unique code, all users can share the same frequency band (range of radio spectrum). This gives many unique advantages to the CDMA technique over other RF techniques in cellular communication.

CDMA is a digital multiple access technique and this cellular aspect of the protocol is specified by the Telecommunications Industry Association (TIA) as IS-95.

In CDMA, the BSSAP is divided into the DTAP and BSMAP (which corresponds to BSSMAP in GSM). The structure of CDMA is shown in the following illustration:

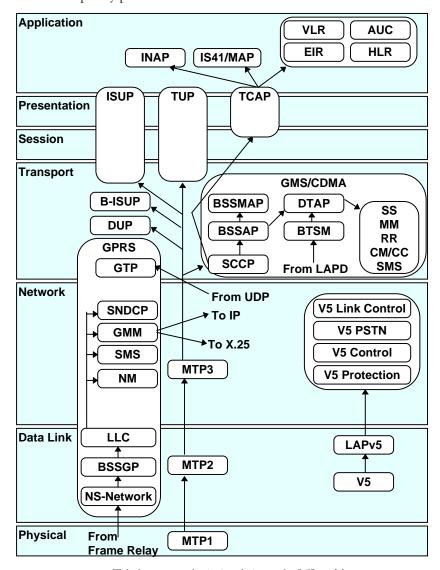


CDMA protocol structure

The following cellular protocols are described in this chapter:

- BSSAP BSS Application Part.
- BSSMAP BSS Management Application Part.
- DTAP (GSM) Direct Transfer Application sub-Part.
- BTSM Base Station Controller to Base Transceiver Station.
- BSMAP Base Station Management Application Part.
- DTAP (CDMA) Direct Transfer Application sub-Part.
- RR Radio Resource.
- MM Mobility Management.
- CC Call Control.
- SMS Short Message Service.

The following diagram illustrates the GSM and CDMA protocols in relation to other telephony protocols and the OSI model:



Telephony protocol suite in relation to the OSI model

BSSAP

GSM 08.06 http://www.etsi.org

The MTP and the SCCP are used to support signalling messages between the Mobile Services Switching Center (MSC) and the Base Station System (BSS). One user function of the SCCP, called BSS Application Part (BSSAP) is defined. In the case of point-to-point calls the BSSAP uses one signalling connection per active mobile station having one or more active transactions for the transfer of layer 3 messages. In the case of a voice group or a broadcast call, there is always one connection per cell involved in the call and one additional connection per BSS for the transmission of layer 3 messages. There is an additional connection for the speaker in a broadcast call, or the first speaker in a voice group call, up to the point at which the network decides to transfer them to a common channel. Additional connections may also be required for any mobile stations in the voice group or broadcast call, which the network decides to place on a dedicated connection. The BSSAP user function is further subdivided into two separate functions:

- The Direct Transfer Application sub-Part (DTAP) is used to transfer messages between the MSC and the MS (Mobile Station). The layer-3 information in these messages is not interpreted by the BSS. The descriptions of the layer 3 protocols for the MS-MSC information exchange are contained in the 04 series of GSM Technical Specifications.
- The BSS Management Application sub-Part (BSSMAP) supports other procedures between the MSC and the BSS, related to the MS (resource management, handover control), or to a cell within the BSS, or to the whole BSS. The description of the layer 3 protocol for the BSSMAP information exchange is contained in GSM 08.08.

Both connectionless and connection-oriented procedures are used to support the BSSMAP. GSM 08.08 explains whether connection oriented or connectionless services should be used for each layer 3 procedure. Connection oriented procedures are used to support the DTAP. A distribution function located in BSSAP, which is reflected in the protocol specification by the layer 3 header, performs the discrimination between the data related to those two subparts.

The format of the BSSAP header is shown in the following illustration:

1 byte	1 byte	
Discrimination	DLCI	Length

BSSAP header structure

Discrimination

Discriminates between the 2 sub-protocols: BSSMAP and DTAP.

DLCI

Only used for DTAP. Used in MSC to BSS messages to indicate the type of origination data link connection over the radio interface.

Length

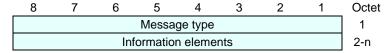
Subsequent layer 3 message parameter length.

BSSMAP

GSM 08.08 http://www.etsi.org

The BSS Management Application Part (BSSMAP) supports all of the procedures between the MSC and the BSS that require interpretation and processing of information related to single call and resource management. Some of the BSSMAP procedures result in, or are triggered by, Radio Resource (RR) management messages defined in GSM 04.08.

The format of the header is shown in the following illustration:



BSSMAP header structure

Message type

Mandatory, one-octet field defining the message type. The message type code uniquely defines the function and format of each BSSMAP message.

Information elements

Each IE has an identifier which is coded as a single octet. The length of an IE may be fixed or variable and may or may not include a length indicator.

DTAP (GSM)

GSM 04.08, 08.06, 08.08 http://www.etsi.org

The Direct Transfer Application Part (DTAP) is used to transfer call control and mobility management messages between the MSC and the MS. The DTAP information in these messages is not interpreted by the BSS. Messages received from the MS are identified as DTAP by the Protocol Discriminator Information Element. The majority of radio interface messages are transferred across the BSS MSC interface by DTAP, except for messages belonging to the Radio Resource (RR) management protocol.

The DTAP function is in charge of transferring layer 3 messages from the MS (or from the MSC) to the MSC (or to the MS) without any analysis of the message contents. The interworking between the layer 2 protocol on the radio side and signalling system 7 at the landside is based on the use of individual SCCP connections for each MS and on the distribution function.

The format of the DTAP header is shown in the following illustration:

8	7	6	5	4	3	2	1	Octet
F	Protocol dis	Transaction / skip			1			
0	N(SD)		Message t					2
	Information elements							3-n

GSM I 3 header structure

Protocol discriminator

Identifies the layer 3 protocol to which the standard layer 3 message belongs. Values may be as follows:

0000 Group call control

0001 Broadcast call control

0010 PDSS1

0011 Call control; call related SS messages

0100 PDSS2

0101 Mobility Management Messages

0110 Radio resources management messages

1001 SMS messages

1011 Non-call related SS messages

1110 Extension of the PD to one octet length

1111 Tests procedures described in TS GSM 11.10



Transaction identifier / skip indicator

Either a transaction identifier, or a skip indictor depending on the level 3 protocol. The transaction identifier contains the transaction value and flag which identifies who allocated the TI.

N(SD)

For MM and CM, N(SD) is set to the value of the send state variable. In other level 3 messages, bit 7 is set to 0 by the sending side. Messages received with bit 7 set to 1 are ignored.

Message type

Uniquely defines the function and format of each GSM L3 message. The message type is mandatory for all messages. The meaning of the message type is therefore dependent on the protocol (the same value may have different meanings in different protocols) and direction (the same value may have different meanings in the same protocol, when sent from the Mobile Station to the network and when sent from the network to the Mobile Station).

Information elements

The message type may be followed by various information elements depending on the protocol.

BTSM

GSM 08.58 http://www.etsi.org

BTSM is the Base Station Controller to Base Transceiver Station (BSC - BTS) interface protocol (the A-bis interface). BTSM allows sending messages between the Base Station Controller and the Base Transceiver Station. Protocol messages consist of a series of information elements. For each message there are mandatory information elements and optional information elements. BTSM messages are transmitted on the A-bis interface using the I format of LAPD, except for the Measurement Result message which is sent in UI format.

The structure of BTSM messages is shown in the following diagram:

8	7	6	5	4	3	2	1	Octet
Message discriminator							1	
	Message type							2
		Inform	nation e	lements	3			3-n

BTSM message structure

Message discriminator

1-octet field used in all messages to discriminate between Transparent and Non-Transparent messages and also between Radio Link Layer Management, Dedicated Channel Management, Common Channel Management and TRX Management messages. The format of the message discriminator is as follows:

8	7	6	5	4	3	2	1	Octet
G7	G6	G5	G4	G3	G2	G1	Т	1

Message discriminator structure

The T-bit is set to 1 to indicate that the message is to be/was considered transparent by BTS. All other messages have the T-bit set to 0. The G-bits are used to group the messages as follows:

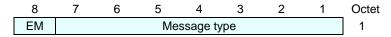
<i>G7-G1</i>	Message group
$0\ 0\ 0\ 0\ 0\ 0\ 0$	Reserved
$0\ 0\ 0\ 0\ 0\ 0\ 1$	Radio Link Layer Management messages
$0\ 0\ 0\ 0\ 1\ 0\ 0$	Dedicated Channel Management messages

Common Channel Management messages 0000110 TRX Management messages 0001000

All other values are reserved for future use.

Message type

Uniquely identifies the function of the message being sent. It is a single octet and coded as follows:



Message discriminator structure

Bit 8 is the extension bit and is reserved for future use. The following message types are used (all other values are reserved):

0000	XXXX	Radio Link Layer Management messages:
	0001	DATA REQuest
	0010	DATA INDication
	0011	ERROR INDication
	0100	ESTablish REQuest
	0101	ESTablish CONFirm
	0110	ESTablish INDication
	0111	RELease REQuest
	1000	RELease CONFirm
	1001	RELease INDication
	1010	UNIT DATA REQuest
	1011	UNIT DATA INDication
0001	xxxx	Common Channel Management/TRX Management
	0004	messages:
	0001	BCCH INFOrmation
	0010	CCCH LOAD INDication
	0011	CHANnel ReQuireD
	0100	DELETE INDication
	0101	PAGING CoMmanD
	0110	IMMEDIATE ASSIGN COMMAND
	0111	SMS BroadCast REQuest
	1001	RF RESource INDication
	1010	SACCH FILLing
	1011	OVERLOAD
	1100	ERROR REPORT

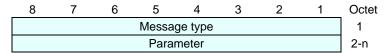
	1101	SMS BroadCast CoMmanD
	1110	CBCH LOAD INDication
	1111	NOTification CoMmanD
001	XXXXX	Dedicated Channel Management messages:
	00001	CHANnel ACTIVation
	00010	CHANnel ACTIVation ACKnowledge
	00011	CHANnel ACTIVation Negative ACK
	00100	CONNection FAILure
	00101	DEACTIVATE SACCH
	00110	ENCRyption CoMmanD
	00111	HANDOver DETection
	01000	MEASurement RESult
	01001	MODE MODIFY REQuest
	01010	MODE MODIFY ACKnowledge
	01011	MODE MODIFY Negative ACKnowledge
	01100	PHYsical CONTEXT REQuest
	01101	PHYsical CONTEXT CONFirm
	01110	RF CHANnel RELease
	01111	MS POWER CONTROL
	10000	BS POWER CONTROL
	10001	PREPROCess CONFIGure
	10010	PREPROCessed MEASurement RESult
	10011	RF CHANnel RELease ACKnowledge
	10100	SACCH INFO MODIFY
	10101	TALKER DETection
	10110	LISTENER DETection

BSMAP

TIA/EIA/IS-634-A, revision A

The Base Station Management Application Part (BSMAP) supports all Radio Resource Management and Facility Management procedures between the MSC and the BS, or to a cell(s) within the BS. BSMAP messages are not passed to the MS, but are used only to perform functions at the MSC or the BS. A BSMAP message (complete layer 3 information) is also used together with a DTAP message to establish a connection for an MS between the BS and the MSC, in response to the first layer 3 interface message sent by the MS to the BS for each MS system request.

The format of the header is shown in the following illustration:



BSMAP header structure

Message type

Mandatory, one-octet field which uniquely defines the function and format of each BSMAP message.

Parameter

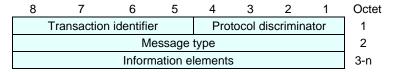
Each parameter has a name which is coded as a single octet. The length of a parameter may be fixed or variable and a length indicator for each parameter may be included.

DTAP (CDMA)

TIA/EIA/IS-634-A, revision A

The Direct Transfer Application Part (DTAP) messages are used to transfer call processing and mobility management messages to and from the MS. The BS does not use DTAP messages, but must map messages going to and coming from the MSC into the appropriate air interface signaling protocol. Transaction IDs are used to associate the DTAP messages with a particular MS and the current call.

The format of the header is shown in the following illustration:



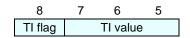
DTAP header structure

Protocol discriminator

The protocol discriminator specifies the message being transferred (CC, MM, RR).

Transaction identifier

Distinguishes multiple parallel activities (transactions) within one mobile station. The format of the transaction identifier is as follows:



Transaction identifier

TI flag

Identifies who allocated the TI value for this transaction. The purpose of the TI flag is to resolve simultaneous attempts to allocate the same TI value.

TI value

TI values are assigned by the side of the interface initiating a transaction. At the beginning of a transaction, a free TI value is chosen and assigned to this transaction. It then remains fixed for the lifetime of the transaction. After a

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transaction ends, the associated TI value is free and may be reassigned to a later transaction. Two identical transaction identifier values may be used when each value pertains to a transaction originated at opposite ends of the interface.

Message Type

The message type defines the function of each DTAP message.

Information elements

Each information element has a name which is coded as a single octet. The length of an information element may be fixed or variable and a length indicator for each one may be included.

RR

GSM 04.08 http://www.etsi.org

Radio Resource (RR) management procedures include the functions related to the management of the common transmission resources, e.g., the physical channels and the data link connections on control channels. The general purpose of Radio Resource procedures is to establish, maintain and release RR connections that allow a point-to-point dialogue between the network and a Mobile Station. This includes the cell selection/reselection and the handover procedures. Moreover, Radio Resource management procedures include the reception of the uni-directional BCCH and CCCH when no RR connection is established. This permits automatic cell selection/reselection.

The format of the RR header is shown in the following illustration:

	8	7	6	5	4	3	2	1	Octet
Ī	Protocol discriminator					Skip in	dicator		1
ĺ	Message type							2	
Information elements							3-n		

RR header structure

Protocol discriminator

0110 identifies the RR Management protocol.

Skip indicator

The value of this field is 0000.

Message type

Uniquely defines the function and format of each RR message. The message type is mandatory for all messages. RR message types may be:

00111 xxx	Channel establishment messages:
011	ADDITIONAL ASSIGNMENT
111	IMMEDIATE ASSIGNMENT
001	IMMEDIATE ASSIGNMENT EXTENDED
010	IMMEDIATE ASSIGNMENT REJECT
00110 xxx	Ciphering messages:
101	CIPHERING MODE COMMAND
010	CIPHERING MODE COMPLETE

00101 xxx 110 001 111 011 100 000 101	Handover messages: ASSIGNMENT COMMAND ASSIGNMENT COMPLETE ASSIGNMENT FAILURE HANDOVER COMMAND HANDOVER COMPLETE HANDOVER FAILURE PHYSICAL INFORMATION
00001 xxx 101 010 111	Channel release messages: CHANNEL RELEASE PARTIAL RELEASE PARTIAL RELEASE COMPLETE
00100 xxx 001 010 100 111	Paging messages: PAGING REQUEST TYPE 1 PAGING REQUEST TYPE 2 PAGING REQUEST TYPE 3 PAGING RESPONSE
00011 xxx 000 001 010 011 100 101 110 111	System information messages: SYSTEM INFORMATION TYPE 8 SYSTEM INFORMATION TYPE 1 SYSTEM INFORMATION TYPE 2 SYSTEM INFORMATION TYPE 3 SYSTEM INFORMATION TYPE 4 SYSTEM INFORMATION TYPE 5 SYSTEM INFORMATION TYPE 6 SYSTEM INFORMATION TYPE 7
00000 xxx 010 011 101 110	System information messages: SYSTEM INFORMATION TYPE 2bis SYSTEM INFORMATION TYPE 2ter SYSTEM INFORMATION TYPE 5bis SYSTEM INFORMATION TYPE 5ter
00010 xxx 000 010 111 100 101 110 011	Miscellaneous messages: CHANNEL MODE MODIFY RR STATUS CHANNEL MODE MODIFY ACKNOWLEDGE FREQUENCY REDEFINITION MEASUREMENT REPORT CLASSMARK CHANGE CLASSMARK ENQUIRY

Information elements

The length of an information element may be fixed or variable and a length indicator for each one may be included.



GSM 04.08 http://www.etsi.org

The main function of the Mobility Management (MM) sub-layer is to support the mobility of user terminals, such as informing the network of its present location and providing user identity confidentiality. A further function of the MM sub-layer is to provide connection management services to the different entities of the upper Connection Management (CM) sublayer.

The format of the header is shown in the following illustration:

	8	7	6	5	4	3	2	1	Octet
Ī	Protocol discriminator					Skip in	dicator		1
Ī	Message type						2		
Information elements							3-n		

MM header structure

Protocol discriminator

0101 identifies the MM protocol.

Skip indicator

The value of this field is 0000.

Message type

Uniquely defines the function and format of each MM message. The message type is mandatory for all messages. Bit 8 is reserved for possible future use as an extension bit. Bit 7 is reserved for the send sequence number in messages sent from the mobile station. MM message types may be:

0x00	XXXX	Registration messages:
	0001	IMSI DETACH INDICATION
	0010	LOCATION UPDATING ACCEPT
	0100	LOCATION UPDATING REJECT
	1000	LOCATION UPDATING REQUEST
0x01	XXXX	Security messages:
	0001	AUTHENTICATION REJECT
	0010	AUTHENTICATION REQUEST

	0100	AUTHENTICATION RESPONSE
	1000	IDENTITY REQUEST
	1001	IDENTITY RESPONSE
	1010	TMSI REALLOCATION COMMAND
	1011	TMSI REALLOCATION COMPLETE
0x10	XXXX	Connection management messages:
	0001	CM SERVICE ACCEPT
	0010	CM SERVICE REJECT
	0011	CM SERVICE ABORT
	0100	CM SERVICE REQUEST
	1000	CM REESTABLISHMENT REQUEST
	1001	ABORT
0x11	XXXX	Miscellaneous messages:
	0001	MM STATUS

Information elements

Various information elements.

CC

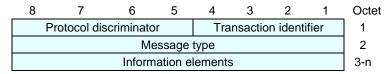
GSM 04.08 http://www.etsi.org

The Call Control (CC) protocol is one of the protocols of the Connection Management (CM) sublayer. Every mobile station must support the Call Control protocol. If a mobile station does not support any bearer capability at all, then it must respond to a SETUP message with a RELEASE COMPLETE message. In the Call Control protocol, more than one CC entity is defined. Each CC entity is independent from another and communicates with the corresponding peer entity using its own MM connection. Different CC entities use different transaction identifiers. Certain sequences of actions of the two peer entities compose elementary procedures. These elementary procedures may be grouped into the following classes:

- Call establishment procedures.
- Call clearing procedures.
- Call information phase procedures.
- Miscellaneous procedures.

The terms mobile originating or mobile originated (MO) are used to describe a call initiated by the mobile station. The terms mobile terminating or mobile terminated (MT) are used to describe a call initiated by the network.

The format of the CC header is shown in the following illustration:



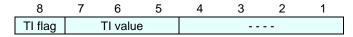
CC header structure

Protocol discriminator

0011 identifies the CC protocol.

Transaction identifier

The transaction identifier distinguishes multiple parallel activities (transactions) within one mobile station. The format of the transaction identifier is as follows:



Transaction identifier

TI flag

Identifies who allocated the TI value for this transaction. The purpose of the TI flag is to resolve simultaneous attempts to allocate the same TI value.

TI value

TI values are assigned by the side of the interface initiating a transaction. At the beginning of a transaction, a free TI value is chosen and assigned to this transaction. It then remains fixed for the lifetime of the transaction. After a transaction ends, the associated TI value is free and may be reassigned to a later transaction. Two identical transaction identifier values may be used when each value pertains to a transaction originated at opposite ends of the interface.

Message type

CC message types may be as follows. Bit 8 is reserved for possible future use as an extension bit. Bit 7 is reserved for the send sequence number in messages sent from the mobile station.

0x00	0000	Escape to nationally specific message types
0x00	XXXX	Call establishment messages:
	0001	ALERTING
	1000	CALL CONFIRMED
	0010	CALL PROCEEDING
	0111	CONNECT
	1111	CONNECT ACKNOWLEDGE
	1110	EMERGENCY SETUP
	0011	PROGRESS
	0101	SETUP
0x01	xxxx	Call information phase messages:
	0111	MODIFY
	1111	MODIFY COMPLETE
	0011	MODIFY REJECT
	0000	USER INFORMATION
	1000	HOLD
	1001	HOLD ACKNOWLEDGE
	1010	HOLD REJECT

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	1100 1101 1110	RETRIEVE RETRIEVE ACKNOWLEDGE RETRIEVE REJECT
0x10	XXXX	Call clearing messages:
	0101	DISCONNECT
	1101	RELEASE
	1010	RELEASE COMPLETE
0x11	XXXX	Miscellaneous messages:
	1001	CONGESTION CONTROL
	1110	NOTIFY
	1101	STATUS
	0100	STATUS ENQUIRY
	0101	START DTMF
	0001	STOP DTMF
	0010	STOP DTMF ACKNOWLEDGE
	0110	START DTMF ACKNOWLEDGE
	0111	START DTMF REJECT
	1010	FACILITY

Information elements

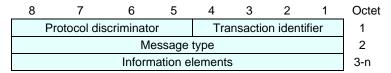
Various information elements.

SMS

GSM 04.11 http://www.etsi.org

The Short Message Service (SMS) is used to transfer text messages over mobile networks between a GSM PLMN Mobile Station and a Short Message Entity via a Service Center. The terms MO (Mobile Originating) and MT (Mobile Terminating) are used to indicate the direction in which the short message is sent.

SMS messages can be control or relay messages. The format of the control protocol message header is shown in the following illustration:



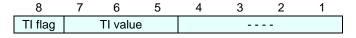
SMS control protocol header structure

Protocol discriminator

1001 identifies the SMS protocol.

Transaction identifier

The transaction identifier (TI) distinguishes multiple parallel activities (transactions) within one mobile station. The format of the transaction identifier is as follows:



Transaction identifier

TI flag

Identifies who allocated the TI value for this transaction. The purpose of the TI flag is to resolve simultaneous attempts to allocate the same TI value.

TI value

TI values are assigned by the side of the interface initiating a transaction. At the beginning of a transaction, a free TI value is chosen and assigned to this transaction. It then remains fixed for the lifetime of the transaction. After a

transaction ends, the associated TI value is free and may be reassigned to a later transaction. Two identical transaction identifier values may be used when each value pertains to a transaction originated at opposite ends of the interface.

Message type

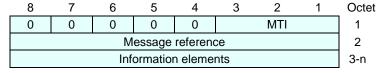
The message type, together with the protocol discriminator, identifies the function of the message being sent. Messages may be of the following:

0000 0001	CP-DATA
0000 0100	CP-ACK
0001 0000	CP-ERROR

Information elements

Each IE has an identifier which is coded as a single octet. The length of an IE may be fixed or variable and may or may not include a length indicator.

The format of the relay protocol message header is shown in the following illustration:



SMS relay protocol header structure

MTI

Message type indicator. Values are as follows:

Bit Value (3 2 1)	Direction	RP-Message
0 0 0	$ms \rightarrow n$	RP-DATA
0 0 0	$n \rightarrow ms$	Reserved
0 0 1	$ms \rightarrow n$	Reserved
0 0 1	$n \rightarrow ms$	RP-DATA
0 1 0	$ms \rightarrow n$	RP-ACK
0 1 0	$n \rightarrow ms$	Reserved
0 1 1	$ms \rightarrow n$	Reserved
0 1 1	$n \rightarrow ms$	RP-ACK
100	$ms \rightarrow n$	RP-ERROR
100	$n \rightarrow ms$	Reserved
1 0 1	$ms \rightarrow n$	Reserved
1 0 1	n -> ms	RP-ERROR

Bit Value (3 2 1)	Direction	RP-Message
1 1 0	$ms \rightarrow n$	RP-SMMA
1 1 0	$n \rightarrow ms$	Reserved
1 1 1	$ms \rightarrow n$	Reserved
1 1 1	$n \rightarrow ms$	Reserved

Message reference

Used to link an RP-ACK message or RP-ERROR message to the associated RP-Data or RP-SMMA message transfer attempt.

Information elements

Each IE has an identifier which is coded as a single octet. The length of an IE may be fixed or variable and may or may not include a length indicator.